

--19. The plasma generation apparatus according to Claim 6, wherein said magnetic force line generator is constructed so as to form said magnetic force line between the one of said two walls and said objects to be treated held by the other of said two walls.--

--20. The plasma generation apparatus according to claim 1, wherein said magnetic force line generator comprises two ring-shaped magnets fashioned so as to enclose said plasma generation region and to be spaced at a prescribed distance apart from each other in the direction of center axis of said discharge electrode.--

--21. The plasma generation apparatus according to claim 16, wherein said magnetic force line generation comprises two ring-shaped magnets fashioned so as to enclose said plasma generation region and to be spaced at a prescribed distance apart from each other in the direction of center axis of said discharge electrode.--

REMARKS

Claims 1-18 are pending. By the Office Action, claims 1,6,14, 16-18 are rejected under 35 USC §112, second paragraph; claims 1-8 and 15-18 are rejected under 35 USC §102(b); and claims 9-15 are rejected under 35 USC §103(a). New claims 19-21 have been added to further define the magnetic force generator. Support for claim 19 can be found at page 21, lines 2-14. Support for claims 20-21 can be found at page 18, lines 11-19. No new matter has been added.

Claims 1, 14 and 16-18 are rejected under 35 USC §112, second paragraph, for being indefinite in the recitation of "--dimension(s) of said center axis..." or "...center axial dimension...". Claim 6 is rejected as failing to conform to U.S. practice. By this Amendment, Claims 1,6, 14, and 16-18 are amended. Applicant respectfully requests the 35 USC §112, second paragraph rejection be withdrawn.

Claims 1-8 and 16-18 are rejected under 35 USC §102(b) as being anticipated by Sato Noriyoshi et al. (JP5-354023 IDS reference). Applicant respectfully requests reconsideration and withdrawal of the rejection because Noriyoshi et al. does not anticipate each and every element of independent claim 1 and the claims 2-8 dependent therefrom. Moreover, Noriyoshi et al. does not anticipate each and every element of independent claims 16-18.

Independent claim 1 is drawn to a plasma generation apparatus comprising: 1) a vacuum vessel that has a plasma generation region established in the interior of the vessel; 2) a gas inductor that forces gas into the vacuum vessel; 3) a tube-shaped discharge electrode; 4) a high-frequency electric power applicator that supplies power to the discharge electrode; 5) a magnetic force line generator that generates magnetic force lines that are roughly parallel to the center axis of the discharge electrode in a fashion that the parallel portions are longer the closer the magnetic force lines are to the center axis; and 6) two walls positioned such that they sandwich the plasma generation region in the center axis of the discharge electrode.

Independent claim 16 is drawn to a plasma generation apparatus comprising the same elements as independent claim 1, except that a) the magnetic force line generator does not contain a limitation to the orientation of the generated magnetic force lines relative to the discharge electrode and b) the two walls contain additional limitations that they contain a substance exhibiting electrical conductivity and that the substrate be located between them.

Independent claim 17 is drawn to a plasma generation apparatus comprising the same elements as independent claim 1, except that it does not recite the two walls structure but contains a limitation to two electrodes positioned to sandwich the plasma generation region between them in the center axis of the discharge electrode and that the plasma generation is shaped such that it does not intersect the two electrodes.

Independent claim 18 is drawn to a plasma generation apparatus comprising the same elements as in independent claim 16, except that it a) recites a first and second high frequency electric power applicator that applies high frequency electric power to at least one of the two discharge electrodes and b) recites two electrodes made of a substance exhibiting electrical conductivity and positioned to sandwich the plasma generation region in the center axis of the discharge electrode, with the substrate located between the two electrodes. Claim 18 does not recite the two walls structure.

Noriyoshi et al. discloses a low pressure surface processor that requires reduced energy for projecting ions onto a substrate to be processed. Structurally, Noriyoshi et al. describes a) a vacuum container; b) an evacuation mechanism; c) a gas introduction mechanism; d) a cylindrical discharging electrode; e) an electrode supply mechanism for supplying power to the discharge electrode; f) a magnetic circuit; g) and at least one substrate holding mechanism; h) a plurality of annular magnets arranged coaxially with the discharging electrode; i) substrate mounted surfaces of the substrate holding mechanisms provided perpendicularly to the center axis of the discharging electrode. Noriyoshi at abstract.

Noriyoshi discloses a magnetic circuit that generates magnetic force lines only in the periphery of the plasma generating region that are capable of trapping electrons. The plasma generated by the device of Noriyoshi is generated in the periphery of the plasma generation region and then diffuses to the center region. Conversely, the plasma generating apparatus of claims 1 and 17 of the instant invention have magnetic force line generators that generate high density plasma in the center as well as the periphery of the plasma generation region.

Accordingly, Noriyoshi fails to anticipate each and every element of the claimed invention in independent claim 1 and dependent claims 2-8.

Moreover, Noriyoshi does not describe the two walls as specified in claims 16-18. Noriyoshi merely describes substrate holding mechanisms and a vacuum container, which the rejection states corresponds to the two walls in claims 16-18. However, it is not disclosed that high frequency electric power is applied to the substrate holding mechanism, and thus the substrate holding mechanism does not function as does the two walls structure in the claimed invention. Moreover, the vacuum container shown in Fig. 1 of Noriyoshi is grounded in such a way that high frequency power is not applied. Thus, Applicant contends that one of skill in the art would not attribute the function of either the substrate holding mechanism or the vacuum container to that of the two walls structure as described in the specification and presently claimed.

Thus, Noriyoshi fails to anticipate independent claims 1 and the claims dependent therefrom, as well as independent claims 16-18, under 35 USC §102(b). Applicant respectfully requests reconsideration and withdrawal of the rejection.

Claim 9 is rejected under 35 USC §103(a) as having been obvious over Sato Noriyoshi et al. (JP5-354023 IDS reference). Applicant respectfully requests reconsideration and withdrawal of the rejection because there was no motivation to arrive at the claimed invention from the teachings of Noriyoshi et al. nor was there any common knowledge to those of skill in the art that could have overcome the deficiencies in Noriyoshi et al. at the time the invention was made.

Dependent claim 9 is drawn to a plasma generation apparatus having all the limitations of Claims 1 and 2, wherein both of the two walls are connected to a reference potential point and the walls are formed of a material exhibiting electrical conductivity.

Noriyoshi et al is discussed above.

The rejection states that both of the two walls connected to a reference potential is not explicitly described in Noriyoshi. Applicant contends that Noriyoshi et al. fails to appreciate the structure of the two walls themselves, the relationship of the two walls to the other elements, the vacuum vessel, the position and configuration of the magnetic force line forming means, and the position of and the interval between the two walls, as described in the specification. Specification at page 5, lines 7-10. Applicant does not understand the recited motivation of plasma volume geometry and impinging energy of the ions resulting in higher quality films or how Noriyoshi et al. provides such motivation. More importantly, the alleged motivations recited in the rejection are not relevant to the operation of the invention.

The problem solved by the claimed invention is the generation of high density plasma in the center and the periphery of the plasma generation region for accurate work performance on miniature devices. Applicant has solved that problem by adding novel and non-obvious structural elements, which interrelate in a manner to accomplish these objects, as discussed above. No scientific evidence of record has been cited by the Office Action to show how motivation to arrive at the claimed plasma generation apparatus would have been obtained with any expectation of success from the stated deficiencies of Noriyoshi. Furthermore, the rejection provides no specific scientific evidence or supplementary reference showing that Noriyoshi is enabling, nor that the properties exhibited by the claimed apparatus are inherent in Noriyoshi.

Thus, there would have been no suggestion of the claimed invention from the surface processor with mere substrate holding mechanism to arrive at the plasma generating apparatus of independent claim 1. Thus, a prima facie case of obviousness under 35 USC §103(a) has not been established for independent claim 1 nor dependent claim 9 over Noriyoshi.

Applicant respectfully requests reconsideration and withdrawal of the 35 USC §103(a) rejection.

Claims 10-13 are rejected under 35 USC §103(a) as being unpatentable over Sato Noriyoshi et al. (JP5-354023 IDS reference) as applied to claims 1-9, 16-18 above, and further in view of Kinoshita et al. (US Patent 5,795,452). Applicant respectfully requests reconsideration and withdrawal of the 35 USC §103(a) rejection because there would have been no suggestion or motivation to arrive at the claimed plasma generation apparatus of independent claim 1 nor dependent claims 10-13 with any expectation of success from the combination device of Noriyoshi and Kinoshita.

Claims 10-13 are drawn to the plasma generation apparatus of claim 1, with the further limitation that it has a controller that controls the magnitude of high-frequency electric power. Noriyoshi et al. is discussed above.

Kinoshita describes a dry process system in which a magnetron discharge is used and includes a phase control unit including a coil and a variable condenser, and a matching box for matching impedance of the first electrode to impedance of the second electrode. Col. 14, lines 12-18. Kinoshita is cited as rendering claims 10-13 obvious because they each contain a further limitation to a control means for controlling the magnitude of high-frequency electric power.

Applicants contend that Kinoshita does not overcome the deficiencies of Noriyoshi with respect to independent claim 1, from which claims 10-13 depend. There is no suggestion or motivation to have arrived at the plasma generation apparatus of claim 1 from the combination device of Noriyoshi and Kinoshita. The combination device would still have the deficiency of Noriyoshi that it does not generate high density plasma in the center region as well as the periphery. Thus, the combination would be inoperative for the claimed purpose

in claim 1 and dependent claims therefrom. Kinoshita merely adds some disclosure about a controller, but the combination device is not enabling nor suggestive of the plasma generation apparatus of claim 1, from which claims 10-13 depend.

Applicant respectfully requests reconsideration and withdrawal of the 35 USC §103(a) rejection.

Claim 14 is rejected under 35 USC §103(a) as being unpatentable over Sato Noriyoshi et al. (JP5-354023 IDS reference) as applied to claims 1-8, 16-18 above, and further in view of Smesny et al. (US Patent 5,444,637). Applicant respectfully requests reconsideration and withdrawal of the 35 USC §103(a) rejection because there would have been no suggestion or motivation to arrive at the claimed plasma generation apparatus of independent claim 1 nor dependent claim 14 with any expectation of success from the combination device of Noriyoshi and Smesny et al.

Claim 14 is drawn to the plasma generation apparatus of claim 1, comprising a position adjuster that adjusts positions of the two walls in the center axis of the discharge electrode. Noriyoshi et al. is discussed above.

Smesny et al. describes a programmable semiconductor wafer for sensing and recording processing conditions to which the wafer is exposed. A description of the wafer being acted upon in accordance with the invention of Smesny cites an integrated circuit dry etching chamber with movable electrode; however, the invention and the description is not principally directed to an etching process or plasma generation process. A suitable gas etchant of a halogen species or freons is also described.

Applicant contends that Smesny does not overcome the repeated deficiencies of Noriyoshi in that the combination device of Noriyoshi and Smesny would not generate high density plasma in the center region, making the device also inoperative for its claimed

purpose. Moreover, Applicant contends that Smesny is principally directed to a programmable semiconductor wafer and appears to be non-analogous art as well as irrelevant.

Thus, Applicant contends that the combination device of Noriyoshi and Smesny would not have motivated one of skill in the art to arrive at the invention of independent claim 1 nor dependent claim 14, with any expectation of success at the time the invention was made. Thus, claim 14 is not obvious over the combination of Noriyoshi and Smesny. Applicant respectfully requests the 35 USC §103(a) be withdrawn.

Claim 15 is rejected under 35 USC §103(a) as being unpatentable over Sato Noriyoshi et al. (JP5-354023 IDS reference) as applied to claims 1-8, 16-18 above, and further in view of Inazawa et al. (US Patent 5,595,627). Applicant respectfully requests reconsideration and withdrawal of the 35 USC §103(a) rejection because there is no suggestion or motivation to arrive at the claimed plasma generation apparatus of independent claim 1 nor dependent claim 15 with any expectation of success from the combination device of Noriyoshi and Inazawa et al.

Claim 15 is drawn to a plasma generation apparatus according to claim 1, with the further limitation that one of the two walls is used as a gas diffusion plate for diffusing the discharge gas in the plasma generation region, and the other wall is used as a holder for holding objects being treated with plasma. Noriyoshi is discussed above.

Inazawa et al. describes a plasma etching apparatus that has an upper electrode that has a hollow interior and a large number of gas diffusion holes formed in its entire surface opposite the entire wafer W. An etching gas is fed into the upper electrode through a gas feed pipe and is uniformly sprayed into the processing chamber through the gas diffusion holes. Col. 4, lines 56-65.


Applicant contends that Inazawa does not overcome the repeated deficiencies of Noriyoshi in that the combination device of Noriyoshi and Inazawa would not generate high density plasma in the center region, making the device inoperative for its claimed purpose. Inazawa et al. merely adds a single limitation to gas diffusion holes. Thus, there would be no motivation to arrive at the claimed plasma generation apparatus of claim 15, from the inoperative combination device of Noriyoshi and Inazawa with any expectation of success at the time the invention was made. Thus, Applicant contends that claim 15 is not obvious over the combination device of Noriyoshi and Inazawa.

Applicant respectfully requests the 35 USC §103(a) rejection be withdrawn. Reconsideration and withdrawal of all rejections are respectfully requested.

In view of the foregoing Amendments and remarks, Applicant respectfully submits that the application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

Should the Examiner believe that anything further would be desirable in order to place the application into even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,


James A. Oliff
Registration No. 27, 075

Joseph K. Hemby, Jr.
Registration No. 42,652

JAO/JKH:amw

Date: February 26, 2001

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

<p>DEPOSIT ACCOUNT USE AUTHORIZATION Please grant any extension necessary for entry; Charge any fee due to our Deposit Account No. 15-0461</p>
--